



SPRING 1999 RELEASE ITEM

Grade 4 Science

How do students provide evidence of what they know and can do in science?

SAMPLE OPEN-RESPONSE QUESTION

The following is an example of an open-response question designed to provide an opportunity for students to show what they know and can do in the area of science:

Changing States

In spring, ice and snow change and become liquid water. In summer, when it rains on the sidewalk, the water “dries up” and becomes water vapor which is a gas.

- Tell what happens to make the ice and snow become liquid and the water on the sidewalk become water vapor.
- Give TWO examples of ways that these changes to water are important in people’s lives.

What is the relationship of the assessment to the curriculum?

SCIENCE CONTENT

The content of the open-response question “Changing States” addresses the following Science Academic Expectation: “Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events”(2.2: Patterns).

This question provides a way for students to show their understanding of several concepts from the *Core Content for Science Assessment*. Students are asked to show their understanding of the different states of water (i.e., solid, liquid, and gas) and of how these states may change. Students are also asked to show their understanding of how these changes that are present in the water cycle relate to the context of a “real-life” situation.



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PERFORMANCE EXPECTATIONS

How good is good enough?

An appropriate student response should provide evidence of the student's understanding of how water changes from one state to another and of how these changes in water are relevant to everyday life.

For example, an appropriate response to this question would show that the student can

- correctly tell what happens to make water change from one state to another (i.e., correctly explain that a transfer of heat energy to water causes water to change from a solid to a liquid to a gas); and
- correctly identify two examples of ways that the changes to water are important in people's lives.

Successful student work should provide convincing evidence that the student can use scientific content knowledge to address the relevant issue(s), although the response may not address all details and may contain some minor flaws.

APPLICATIONS

How is this relevant?

This question addresses the fundamental aspects of scientific thinking and conceptual understanding. By successfully answering this question, students demonstrate an understanding of the cyclical pattern of water changes on Earth, the reason for these changes, and the relevance of these changes to people's lives. This knowledge will help students better understand other cyclical patterns related to Earth's components (e.g., soil erosion, recycling, weather changes) and of how these cycles can affect everyday life.



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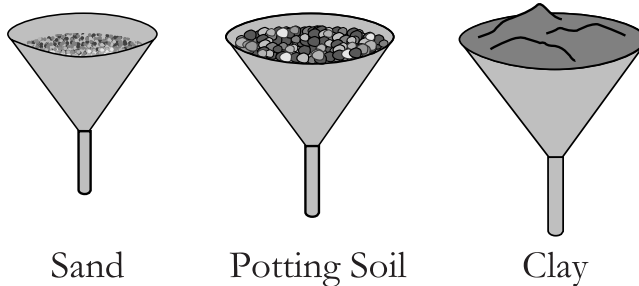
SAMPLE OPEN-RESPONSE QUESTION

How do students provide evidence of what they know and can do in science?

The following is an example of an open-response question designed to provide an opportunity for students to show what they know and can do in the area of science:

Joe's Soil Experiment

Joe is doing an experiment to find out which type of soil soaks up the most water. He starts by getting three funnels and putting a different type of soil into each.



Joe then pours water into each funnel until water begins to drip from the bottom. His experiment has some mistakes.

- Describe TWO of the mistakes in the design of Joe's experiment.
- Describe how Joe could correct the mistakes you described in **part a**.

SCIENCE CONTENT

What is the relationship of the assessment to the curriculum?

The content of the open-response question "Joe's Soil Experiment" addresses the following Science Academic Expectation: "Students understand scientific ways of thinking and working and use those methods to solve real-life problems" (2.1: Nature of Scientific Activity).

This question provides a way for students to show their understanding of several concepts from the *Core Content for Science Assessment*. Most importantly, students are provided an opportunity to demonstrate an understanding of what constitutes a fair test or experiment. In answering the question, students will also show their understanding of investigations that involve comparisons and of investigations that involve the use of simple instruments.



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How good is good enough?

An appropriate student response should provide evidence of the student's understanding of how to conduct a fair test or experiment and the ability to suggest valid methods for correcting mistakes made in an experiment.

For example, an appropriate response to this question would show that the student can

- clearly understand the concept of a fair test or experiment;
- clearly and accurately describe two of the mistakes in the design of Joe's experiment (e.g., describe how the funnel sizes and the amounts of soil are different); and
- clearly and accurately describe how Joe could correct the mistakes identified (e.g., describe how Joe could use the same-sized funnels and the same amounts of soil).

Successful student work should provide convincing evidence that the student can use scientific content knowledge and inquiry skills to address the relevant issue(s), although the response may not address all details and may contain some minor flaws.

APPLICATIONS

How is this relevant?

This question addresses the fundamental aspects of scientific thinking and problem solving. By successfully answering this question, students demonstrate an ability to recognize appropriate scientific design procedures, to identify mistakes in a scientific procedure, and to propose solutions to correcting the identified mistakes. This ability will be useful to students both in school (e.g., in a variety of science classes) and in adult life (e.g., in performing scientific investigations to solve problems encountered in every day life; in analyzing the validity of the results of scientific investigations).



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The following is an example of an open-response question designed to provide an opportunity for students to show what they know and can do in the area of science:

Earth Materials

Some of Earth's materials are:

- soil
 - water
 - gases of the atmosphere
- a. Choose TWO materials from the list above. Explain how a PLANT uses these materials to live.
 - b. Choose TWO materials from the list above. Explain how an ANIMAL uses these materials to live.

What is the relationship of the assessment to the curriculum?

SCIENCE CONTENT

The content of the open-response question "Earth Materials" addresses the following Science Academic Expectation: "Students identify and analyze systems and the ways in which their components work together or affect each other" (2.3: Systems and Interactions).

This question provides a way for students to show their understanding of several concepts from the *Core Content for Science Assessment*. Most importantly, students are asked to show their understanding of the basic needs of living organisms and of how organisms use Earth materials to fulfill these basic needs. In answering this question, students are also asked to show their understanding of how plants and animals survive.



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PERFORMANCE EXPECTATIONS

How good is good enough?

An appropriate student response should provide evidence of the student's understanding of the basic needs of organisms and of how Earth materials are used by the organisms to fulfill these needs.

For example, an appropriate response to this question would show that the student can

- clearly and accurately explain how a plant uses two selected Earth materials (i.e., soil, water, or gases of the atmosphere) to live; and
- clearly and accurately explain how an animal uses two selected Earth materials (i.e., soil, water, or gases of the atmosphere) to live.

Successful student work should provide evidence that the student can use scientific content knowledge to address the relevant issue(s), although the response may not address all details and may contain some minor flaws.

APPLICATIONS

How is this relevant?

This question addresses the fundamental aspects of scientific thinking, as well as a conceptual understanding of the interaction between biotic systems (e.g., living plants and animals) and abiotic systems (e.g., Earth materials). By successfully answering this question, students demonstrate an understanding of how the basic needs of plants and animals are provided by the fundamental solids, liquids, and gases present on Earth. This knowledge may be useful to students in various ways, including helping them to grow plants, take care of animals, take care of the environment, and, when they are adults, make informed decisions about issues that concern the environment.



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The following is an example of an open-response question designed to provide an opportunity for students to show what they know and can do in the area of science:

Cooling Down

You are sitting in a hot, sunny place, and you begin to sweat.

- What happens to the sweat on your body as you sit in the sun?
- How does sweating make your body feel cooler?

What is the relationship of the assessment to the curriculum?

SCIENCE CONTENT

The content of the open-response question “Cooling Down” addresses the following Science Academic Expectation: “Students identify and analyze systems and the ways in which their components work together or affect each other” (2.3: Systems and Interactions).

This question provides a way for students to show their understanding of several concepts from the *Core Content for Science Assessment*. Students have an opportunity to show their understanding of different states of water (i.e., liquid and gas), of how water can be changed from one state to another by heating or cooling, and of how this change takes place on the human body.



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How good is good enough?

An appropriate student response should provide evidence of the student's understanding of the composition of sweat (i.e., it is mostly water), of different states of water (i.e., liquid and gas), and of how water in the form of sweat is changed by heat from the human body into a gaseous state.

For example, an appropriate response to this question would show that the student can

- clearly understand the nature of sweat and its change of state from liquid to gas;
- clearly and accurately explain what happens to sweat on a body of someone who is sitting in the sun (i.e., explain that the sweat evaporates); and
- clearly and accurately explain how sweating can make the body feel cooler (i.e., explain that heat is transferred from the body to the water on the skin and, as the water evaporates, the loss of that heat results in the body feeling cooler).

Successful student work should provide evidence that the student can use scientific content knowledge to address the relevant issue(s), although the response may not address all details and may contain some minor flaws.

APPLICATIONS

How is this relevant?

By successfully answering this question, students demonstrate an ability to answer questions about an event in the environment, construct a reasonable explanation about the event, and communicate that explanation to others. Students also demonstrate an understanding of how a biotic system (i.e., the human body) may interact with an abiotic system (i.e., the Earth materials of water and atmospheric gases). This ability and knowledge will be useful to students as they explore and investigate objects, organisms, and events in the environment.